

SEMI-ANNUAL PROGRESS REPORT NO. 2

May 1, 1974 - October 31, 1974

APPLICATION OF REMOTE SENSING TO STATE AND REGIONAL PROBLEMS

NASA GRANT NGL-25-001-054

(NASA-CR-140805) APPLICATION OF REMOTE  
SENSING TO STATE AND REGIONAL PROBLEMS  
Semiannual Progress Report, 1 May - 31  
Oct. 1974 (Mississippi State Univ.)  
24 p HC \$3.25

N75-11414

Unclas  
02799

CSSL 08B G3/43

Submitted To:

Office of University Affairs  
Headquarters  
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION  
Washington, D. C.

**PRICES SUBJECT TO CHANGE**

Submitted By:

W. Frank Miller\*

C. W. Bouchillon\*\*

J. C. Harris

Brad Carter

Frank Whisler

Randell Robinette

MISSISSIPPI STATE UNIVERSITY  
Drawer FD  
Mississippi State, MS 39762

October 31, 1974

Reproduced by  
**NATIONAL TECHNICAL  
INFORMATION SERVICE**  
US Department of Commerce  
Springfield, VA. 22151

\* Program Coordinator

\*\*Principal Investigator

## SEMI-ANNUAL PROGRESS REPORT NO. 2

May 1, 1974 - October 31, 1974

### APPLICATION OF REMOTE SENSING TO STATE AND REGIONAL PROBLEMS

#### I. INTRODUCTION

The primary purpose of the Remote Sensing Applications Program is for various members of the university community to participate in activities that improve the effective communication between the scientific community engaged in remote sensing research and development and the potential users of modern remote sensing technology. The state-of-the-art remote sensing capability is significantly beyond the present-day applications of the potential user group. The program serves to accelerate the use of state-of-the-art remote sensing capabilities which will help to insure reasonable pay-off from and better usage of space, high altitude, and other remote sensing capabilities largely evolved by the NASA program.

Activities of this program are assisting the State of Mississippi in recognizing and solving its environmental, resource and socio-economic problems through inventory, analysis, and monitoring by appropriate remote sensing systems.

In order to achieve this purpose, the participants in this program and collaborating departments are interacting with state and federal agencies, councils of government, counties, and urban groups in the following ways:

/

1. Identifying and updating state and local problems which remote sensing can help solve.
2. Assisting potential users to learn how better to use remote sensing where it is appropriate to the solution of specified problems.
3. Conducting remote sensing applications programs to bring remote sensing technology to bear upon the solution of selected high priority problems.
4. Identifying additional research needs to which remote sensing technology may be applied and establishing priorities for meeting these needs.
5. Stimulating, guiding, and aiding the faculty and students at MSU and others in the state of Mississippi to utilize information from the NASA Earth Resources Satellite and Aircraft Programs in research and public service activities. This program is augmented by the program of the Land Use Center of the Cooperative Extension Service at MSU.
6. Provide a center of expertise and an operational laboratory for short-course training (a schedule of the first is presented below), assistance to departments and agencies in utilizing appropriate remote sensing technology in solving their problems (Appendix A, B, C), and making certain specialized equipment available to users.

Program participants consist of interested faculty researchers in the multifaceted aspects of the application of remote sensing techniques to problems in Mississippi, the region, the nation, and the world. The program participants are organized so as to help foster the growth and improved effectiveness of the group and strive toward accomplishing the purposes of the program.

C. W. Bouchillon, Director of the Institute for Environmental Studies, is serving as Principal Investigator; and W. Frank Miller, Associate Professor of Forestry, is serving as Program Coordinator. Other key personnel in the program include: Timothy Cannon, Research Associate in Forestry; C. A. Taylor and J. C. Harris, Landscape Architecture; Frank Whisler, Professor of Agronomy Soils; Randel Robinette, Assistant Professor of Wildlife and Fisheries; and V. L. Zitta, Assistant Professor of Civil Engineering.

## II. PROJECT PROGRESS REPORTS

### A. Bark Beetle Project - Copiah County

#### Objective

The objective of this study is to provide information to the Mississippi Forestry Commission on the location of high-risk pine stands; that is, those stands which have a high risk of bark beetle attack due to high stand density and/or internal water stress.

#### Accomplishments

Following a May spotting flight by the Mississippi Forestry Commission, and upon receipt of the aerial imagery provided by

the Marshall Space Flight Center, a field crew from the Department of Forestry, Mississippi State University, visited Copiah County and collected site and stand data on 32 infestation spots. These data consisted of locational information, topographic situation, physical soil data, vegetation associated with the infestation area, and the species, basal area, age and average height of the attacked stand. Bulk soil samples were also collected from representative soil and topographic situations and brought to MSU for determination of available water characteristics of the samples.

An analysis of the plot information indicated that:

1. On only 50% of the plots did there occur detectable evidence of damage or disturbance which could be considered as a casual factor in the infestation.

2. Stands in which attacks occurred ranged widely in basal area per acre, but when the denser portions of the stands were examined, the mean basal area was 118 square feet with 71% of the plots having either a high or low site index; the plots with apparent damage average 10 square feet per acre less basal area and only 29% of the plots were of either high or low site index. The apparent correlation illustrated here is that under epidemic conditions, damage to trees either by lightning, blow-down, logging damage, or wind-broken limbs will result more likely in infestation even though stand density is relatively low, and internal stress is not a factor.

### Current Status

Since the required late summer imagery was not obtained, it was impossible to formulate firm hypotheses concerning casual factors. Ground truth data will continue to be collected on a much reduced level of intensity in anticipation of a late spring flight.

### Plans

Work inputs will remain at a greatly reduced level until another flight can be scheduled.

Mapping of high risk areas, as defined by the limited amount of data available, will be initiated upon receipt of the Zoom Transfer Scope; the imagery utilized will be the available high altitude (1:120,000) winter season, color infrared positive transparencies.

### B. State Park Location - Adams County

#### Objective

The objective of this project is to provide information to the Mississippi Park Commission which will enable their planners to select an area in western Adams County which will have the greatest attractiveness and the lowest vulnerability for development of a new State Park.

#### Accomplishments

The data inventory was completed in October, and the data were entered into a computerized geo-information system. The data were obtained both from 1:62,500 U.S.G.S. Quadrangle maps, and from 1:120,000 winter season, color infrared positive trans-

parencies. The variables entered into the system are as follows:

1. Centroid elevation
2. Topographic aspect (direction of slope)
3. Slope percent
4. Topographic position in the landscape
5. Broad soil textural class
6. Soil water regime
7. Type of surface water (stream, lake, etc.)
8. Dominant forest overstory species
9. Forest stand density
10. Forest stand size
11. Nature of agricultural activity
12. Presence of mineral or mining activity
13. Type of residential development
14. Type of other development
15. Nature of transportation network
- 16, 17, 18. Travel time from various important intersections
19. Proximity to existing roads
20. Proximity to existing surface water bodies
21. Proximity to proposed lakes

Matrices were developed utilizing the variable listed, and the geo-information systems produced a series of printout maps indicating the attractiveness of each of the 12,862 ten-acre cells for given recreational useages; park building development, day use, camping, extensive recreation, beaches, transportation systems, etc. In a similar manner, matrices were developed in cooperation with various specialty groups such as soil physicists, wildlife managers, hydrologists, and fishery management specialists that would indicate the vulnerability of a given set of physical and biological parameters to types of recreational impacts.

On the basis of an examination of the combined print-out maps, several potential park sites were delineated. At a

joint session of Park Commission personnel and Mississippi State University personnel involved in this project, the locations and basic data were presented, and provided to the Park Commission at the end of the session.

#### Current Status

Slight improvements are being made in the variable coding system; however, no additional work will be initiated until another meeting is held with Park Commission personnel.

#### Plans

Commission personnel will spend several days with project personnel after the Commission has had an opportunity to assimilate the initial output. At the end of the second meeting, it is anticipated that the choice of location will be narrowed to two sites. These sites will then be subjected to a more detailed analysis.

### C. Waste Source Location and Stream Channel Geometry

#### Objective

The objective in this project is two-fold: first, to determine the feasibility of remote sensing techniques in monitoring point and non-point source pollution sources; and second, to reduce the level of effort required to obtain basic stream channel hydrologic characteristics and waste source location for input into mathematical models for water quality assessment and waste load allocation.



### Accomplishments

A preliminary analysis of data from 16 controlled ponds flown at intervals from June through July with a light aircraft and hand-held 35 mm cameras indicates that color infrared film is superior to Ektachrome aerial color for detection of both organic and inorganic solids. Graphical analysis indicates that there are significant correlations between Munsell color codes in the Blue-Green, Green, and Blue Hues, and various parameters of water pollution such as total suspended inorganic solids, phosphorus content, and chlorophyll content.

### Plans

Multiple regression analysis will be performed on all dates and all ponds, and then on selected high turbidity versus low turbidity ponds on all dates. Depending on the results of this preliminary statistical analyses, the color codes will be re-examined and perhaps redefined in order to achieve higher significance.

The project will be terminated on 31 December, 1974.

8

### III. LIST OF SPECIAL ASSISTANCE OFFERED

A listing of assistance provided to various users since the first Semi-Annual Report is given in Appendix A. With the large data file available, and increasing awareness of the availability of these data, an increase in use of the Applications laboratory is anticipated.

### IV. SHORT COURSES AND WORKSHOPS

The first Workshop presented was designed to make representatives of State and Federal organizations located in Mississippi aware of the general capabilities of remote sensing. A listing of the personnel and organizations represented is presented in Appendix D.

The second Workshop evolved from the first and dealt specifically with the applications of remote sensing in the area of geology, with emphasis on mapping for environmental geology reports. The program for this Workshop program is presented in Appendix B.

### V. MISCELLANEOUS PROJECT RELATED INFORMATION

Several indications of actual use of remotely sensed data from the Applications Laboratory are presented in Appendix C, and a list of recent papers presented to various interested potential user-groups is presented in Appendix E.

### VI. PLANS FOR ADDITIONAL EFFORT

Recent conversations with the Yazoo-Little Tallahatchie Watershed Project, U. S. Forest Service, have indicated a pressing need for a 12 county survey of critical areas which must be planted for erosion control. Tentative plans are for the Applications Program to

demonstrate appropriate techniques for identification of these critical areas on available imagery. The Watershed Project personnel will then employ these techniques for the remaining 11 counties.

In addition, cooperation with the Mississippi National Forests, U. S. Forest Service in demonstrating the use of remote sensing in land capability classification is anticipated; the Mississippi Forestry Commission is also developing an aerial survey technique for inventory of 16th section lands for which they have management responsibility.

APPENDIX A

ASSISTANCE RENDERED BY THE MSU REMOTE SENSING APPLICATIONS LAB

//

# ASSISTANCE RENDERED BY MSU REMOTE SENSING APPLICATION LAB

<u>Date</u>	<u>Individual</u>	<u>Organization</u>	<u>Purpose</u>	<u>Data &amp; Equipment Used</u>	<u>Duration</u>
4/22/74	L. Autry	Weyerhaeuser Columbus, MS	Nursery Site Location	Flood Imagery, Zoom 240	1 hour
5/6&7/74	B. Teels	Soil Conser. Ser. Jackson, MS	Impact Statement	Copiah Co., Zoom 240	12 hours
5/7/74	L. Cantelou	Weyerhaeuser Columbus, MS	Nursery Sites	Flood Imagery & Maps	1 1/2 hours
5/22&23/74	ten participants	Various agencies MS	Workshop, general	NASA & ERTS, all equip.	44 hours
6/24&25/74	A. Bruce	Weyerhaeuser Tacoma, WA	Impact Statement	NASA Ms 192 & Maps, Z 240	5 hours
6/27/74	C. Blakeman	Anthro. Dept. MSU	Archeol. Survey	MSFC & NASA Ms 206, Z 240	1 1/2 hours
7/11/74	S. Kinsman G. Waldow	Stanley Consult. Muscatine, Iowa	Aberdeen Impound.	NASA 197 7 Maps, Zoom 240	2 hours
9/6/74	J. Sigrest	Warren Hood Ind. Hazelhurst, MS	FO & WL Mgt. Plans	MSFC # 29, Zoom 240	4 hours
9/11/74	J. Phillips	Miss. For. Comm. Hazelhurst, MS	16th Sect. Mapping	MSFC # 29, Zoom 240	2 1/2 hours
9/30/74	H. Burner	Weyerhaeuser AL-MS area	Planning & Coord.	NASA 1:120,000, Z 240	2 1/2 hours
10/24/74	A. Master	Tumlinson Planners West Point, MS	Pickensville cut	NASA Ms 215, Z 250	1 hour

12

APPENDIX B

REMOTE SENSING WORKSHOP #2

Applications of ERTS and High Altitude Aircraft Imagery in Geology

# APPLICATIONS OF ERTS AND HIGH ALTITUDE AIRCRAFT IMAGERY IN GEOLOGY

November 6, 1974

Mississippi State University Department of Forestry  
and The Institute for Environmental Studies

Office of University Affairs, National Aeronautics  
and Space Administration

## Faculty

Dan Sapp, Chief  
Remote Sensing Section  
Geological Survey of Alabama

Gary North, Chief  
EROS Experiments and Evaluation Office  
Department of Interior

Frank Miller, Assoc. Program Coordinator  
Remote Sensing Applications  
Mississippi State University

Dr. E. E. Russell, Professor  
Department of Geology  
Mississippi State University

## Participants

Members of State Geological Surveys from Tennessee, Arkansas, Kentucky, Georgia, Oklahoma, and Mississippi are invited, as well as faculty members from the respective Land Grant Universities.

## Course Objective

To provide the participants with a working knowledge of the capabilities and limitations of various types of imagery as applied in the area of geologic surveys.

## Course Duration

1½ days

## Course Content

6 November, 1974

1:30 P.M.

Examples of Imagery Applications by the Geological  
Survey of Alabama. Dan Sapp, GSA.

14

3:30 P.M. Coffee  
3:45 P.M. Geologic Applications - The EROS Program.  
Mr. Gary North  
5:00 P.M. Adjourn

7 November

8:00 A.M. Terrain Analysis: Interpretations for Environmental  
Geology. Frank Miller, Mississippi State University.  
9:00 A.M. Seminar - Interpretations for Environmental Geologists.  
Dr. Russell, Frank Miller, Mississippi State University.  
10:30 A.M. Workshop Session. Each participant will be provided  
with ERTS imagery for a portion of his state, and he  
will produce:  
1. a physiographic map  
2. an environmental geology map  
(landscape units)  
3. a hydrologic map  
ERTS imagery at a scale of 1:1,000,000 and will be  
provided. Frank Miller, Mississippi State University.  
3:00 P.M. Summary

15



## APPENDIX C

### GENERAL APPLICATIONS OF REMOTE SENSING TECHNIQUES

-17-

**STANLEY CONSULTANTS, INC**

STANLEY BUILDING  
MUSCATINE, IOWA 52761  
TELEPHONE: 319/263-9494  
CABLE: STANLEY MUSCATINE IOWA  
TELEX: 468402

November 1, 1974

Professor Frank Miller  
Institute for Environmental Studies  
Department of Forestry  
Mississippi State University  
Starkville, Mississippi 39759

Dear Frank:

In response to your request for a description of Stanley Consultants use of the information you supplied to us through the Mobile District Corps, the following summarizes the contribution of the remote sensing data and interpretive report.

Stanley Consultants was retained by the Army Corps of Engineers, Mobile District Office, to prepare design memoranda for navigation channel alignment, public-use land requirements, and reservoir clearing for a portion of the Tennessee-Tombigbee Waterway in Mississippi. An Ecological Study of the Tennessee-Tombigbee Waterway and the plant association and wildlife habitat maps compiled in your lab from remote sensing data were essential to our planning approach. Determination of the navigation channel alignment and spoil disposal sites involved detailed analyses of environmental, economic, and navigational aspects of three alternatives. Assessment of the environmental setting and quantified analyses of the environmental impacts of the three routes were based largely on the information available from Mississippi State's study and interpretation of the remote sensing data.

The ecological study analyzed the wildlife and timber productivity potential of each plant association identified along the waterway route. Because our entire project area had been mapped to individual plant communities, we were able to prepare overlay maps keyed to areas of high productivity, medium productivity, and low productivity. These maps allowed the project team to visually comprehend the total setting and to consider the relative wildlife and/or timber values of individual areas. The maps also served as working guides for engineers and biologists to route the channel through less productive areas and to avoid good wildlife habitat and uncommon or fragile communities. Similarly, spoil disposal sites were chosen to utilize less productive areas.

Further, we were able to quantify a comparison of the environmental impacts of the three alternative channel routes by measuring the acreages of each type of plant association affected. This quantification from your maps and interpretations from the accompanying narrative provided input to environmental recommendations for channel alignment and spoil site location.

The remote sensing maps and study also helped in other areas: determining the plant composition of inaccessible areas; understanding plant/water/soil relationships; precise location of water tolerant tree species for areas to be left uncleared; and continual reference in the field and the lab. We also anticipate that the data can be useful for future studies on project impact.

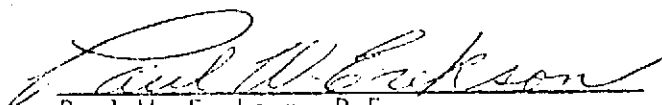
Our experience on this project with use of remote sensing has pointed out the value of availability of these data for design stage planning. It is often possible to identify the environmental details that should be considered at the design stage, but without parallel detailed site data, environmental guidelines can only be given general consideration. In this case (Columbus and Aberdeen Lakes on the Tenn-Tom Waterway), the data available to us allowed the formation of specific environmental guidelines and the consideration of specific areas. For this reason, the background data compiled by Mississippi State University added depth and comprehensiveness to our design studies.

We appreciate your enthusiasm and willingness to share your knowledge, ideas, and methods with us.

Sincerely,

STANLEY CONSULTANTS, INC.

  
Sharon Kinsman, Environment Analyst

  
Paul W. Erickson, P.E.  
Project Manager

SK:klg:6174

-18-

MISSISSIPPI GEOLOGICAL ECONOMIC  
&

TOPOGRAPHICAL SURVEY



SURVEY BOARD  
GORDON W. GULMON, NATCHEZ  
CHAIRMAN  
JAMES G. HAWKINS, COLUMBUS  
VICE CHAIRMAN  
ROBERT L. ABNEY, BAY SPRINGS  
O. B. CURTIS, JACKSON  
TROY J. LASWELL, STARKVILLE

WILLIAM H. MOORE, DIRECTOR & STATE GEOLOGIST

2325 N. WEST STREET  
POST OFFICE BOX 4915  
JACKSON, MISSISSIPPI 39216  
(601) 354-6228

June 6, 1974

Dr. Frank Miller  
Forestry Department  
Drawer FD  
Mississippi State, Miss. 39762

Dear Frank:

I wish to convey my appreciation to you, Tim, and the other members of the Department for your efforts in making the Remote Sensing Workshop not only a learning experience but a most enjoyable one also.

The workshop was well organized and smoothly conducted in spite of uncooperative weather conditions during the early part of the week.

Other staff members, here at the Survey, have expressed an interest in attending a similar workshop should one be offered in the future. We would be particularly interested if you might allocate more time to actual mapping techniques and elaborate on your methods used in Alabama in geologic mapping.

Again I want to express my appreciation for a very well conducted workshop from which I got an insight into how we here at the Survey might better use aerial photography and ERTS imagery.

Sincerely yours,

MISSISSIPPI GEOLOGICAL SURVEY

*David Ray Williamson*

David Ray Williamson  
Geologist

DRW/ns

- 19 -

## APPENDIX D

### ATTENDANCE AT THE FIRST REMOTE SENSING WORKSHOP

Mr. James R. Crouch  
U. S. Forest Service  
Box 69  
Oxford, MS 38655

Mr. Kent Michaelson  
Miss. Research & Development Center  
Drawer 2470  
Jackson, MS 39205

Mr. Bruce Hanson  
Tennessee-Tombigbee Waterway Authority  
Drawer 671  
Columbus, MS 39701

Mr. David R. Williamson  
Box 4915  
Mississippi Geological Survey  
Jackson, MS 39216

Mr. John Belmore  
U. S. Forest Service  
Box 1291  
Laurel, MS

Mr. Tom Spencer  
Tom Spencer & Associates  
2675 River Ridge  
Box 4328  
Jackson, MS 39216

Mr. Billy E. Page  
U. S. Forest Service  
Batesville Security Bank  
Batesville, MS 38606

Donnie R. Richardson  
U. S. Forest Service  
Batesville Security Bank  
Batesville, MS 38606

Mr. Huge Cowsert  
Tenn.-Tombigbee Waterway Authority  
Drawer 671  
Columbus, MS 39701

Mr. Kenneth C. Bracy  
U. S. Forest Service  
Meadville, MS 39653

Mr. Paul Johnson  
U. S. Forest Service  
Box 30  
Forest, MS 39074

Mr. Michael Golden  
Alabama A&M University

21

APPENDIX E

PROJECT-RELATED PUBLICATIONS OR PAPERS PRESENTED

Miller, W. Frank

Remote Sensing Applications in Agronomy. A paper presented at the Mississippi Section of Farm Managers and Rural Appraisers, March 16, 1974. Mississippi State, MS.

New Techniques for Land Classification. A paper presented at the Mississippi Section, Farm and Land Brokers Association. May 23, 1974. Starkville, MS.

Terrain Analysis for Physiographic Classification. A workshop presented at the annual meeting of the Southern Forest Environmental Research Council, August 14, 15, 1974. Georgetown, SC.

Using New Photographic Techniques to Improve Forest Resource Management. A paper presented at the Southern Region, U. S. Forest Service, Soil and Water Workshop, October 21-25, 1974. Memphis, TN.